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Forest Research Notes

Northeastern Forest
Experiment Station
FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 102 MOTORS AVENUE, UPPER DARBY, PA.

No. 119
1961

REGENERATING THE LAST STRIPS IN STRIP-CUTTINGS IN VIRGINIA PINE

When Virginia pine (Pinus virginiana Mill.) is logged, even in pure stands, its natural regeneration is not readily achieved. This is because the species is intolerant and commonly functions in nature as a transitory pioneer; hardwoods become established under its canopy and tend to dominate the reproduction after the pine is cut. Experience indicates that the most practicable harvesting method for perpetuation of the pine is some form of clear cutting.

One such method is to cut by strips, where one-half to two-thirds of an area is harvested in an initial cut (fig. 1), and the intervening strips cut a few years later. With suitable seedbed treatment, such as burning or scarification, the first-cut strips usually restock to pine within 3 years by seeding from the uncut strips. A greater problem is posed by the harvesting of the uncut strips: With no seedbed treatment, advance pine reproduction usually is sparse, and logging removes the seed source. Even if logged during fall and winter, successful regeneration of these strips to pine depends entirely on whatever seed were produced in that one year's crop. If that fails, the last chance for regeneration by natural seeding is gone.

The best solution to the problem of regenerating the strips of the second or final cut appears to lie in greatly increasing the establishment of advance pine reproduction. To learn how to do this was the object of research begun in 1953 on the Beltsville Experimental Forest in Maryland.

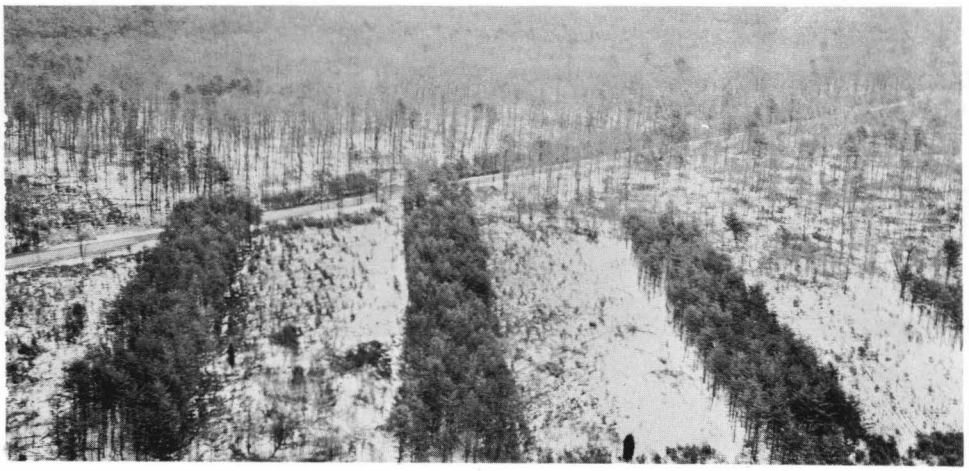

Figure 1.--Aerial view of alternating cut and uncut strips in a strip cutting of Virginia pine.

Bramble (1947) and Slocum and Miller (1953) have shown that seedbed disturbance beneath mature stands greatly favors Virginia pine seed germination and seedling survival. The Beltsville study, therefore, was concentrated on ways to increase advance reproduction by treating the seedbed. Fire and scarification were tested both singly and in combination.

THE STUDY

The study was conducted in a pure, 40-year-old Virginia pine stand containing about 300 pulpwood-size trees per acre. The initial strip cuttings, two chains wide, were made in 1953, leaving alternate uncut strips one chain wide. In each of two uncut strips six 1/20-acre plots, 33 by 66 feet, were laid out with the long dimensions across the strips. All the plots supported a poorly developed hardwood understory with little ground vegetation. Covering the clay loam topsoil were 1 to 2 inches of litter and an inch of mull.

Six seedbed conditions representing all combinations of two burning and three scarification treatments were tested in two replicates. The burning treatments were (1) burn before seedfall, and (2) no burn; the scarification treatments were (1) scarify before seedfall, (2) scarify after seedfall, and (3) no scarification.

Treatments were applied in 1954, about a year after the initial strip cutting. It was a mediocre seed year. The burning was done in early September; the preseedfall

scarification in mid-October; and the postseedfall scarification in early December. The preseedfall treatments were completed well in advance of natural seed dispersal, but it has since been learned that, at the time of the postseedfall scarification in December, probably less than half of the seed crop had fallen (Sucoff and Church, 1960).

The fires for the burning treatments progressed very slowly, smouldering at least 18 hours. A powered garden tractor with a harrow was used for the scarification treatments because it was impractical to maneuver larger equipment in the dense stand. Even this light equipment proved difficult and time-consuming to operate, and scarification was not uniform.

Counts of reproduction were made in October of 1955, 1956, and 1958. Data were analyzed by analysis of variance, and differences among treatment means were compared according to Duncan's multiple range test (Duncan, 1955).

RESULTS

Because the fires moved slowly and burned long and deep, most of the litter and understory vegetation was con-

Table 1.--Pine seedlings per acre after different treatments, in the uncut strips of a strip-cutting operation in a mature Virginia pine stand

Years from treatment	Scarification treatment	Burning treatment	
		None	Burned
1	None	2,000a[1]	3,000a
	Before seedfall	2,800a	6,400 b
	After seedfall	1,300a	6,500 b
2	None	2,000a	5,500 bc
	Before seedfall	4,800 b	6,600 c
	After seedfall	1,500a	6,600 c
4	None	2,000a	7,800 b
	Before seedfall	7,400 b	8,300 b
	After seedfall	4,300a	11,000 c

[1]Means within any one year followed by the same letter are not significantly different from each other at the 5-percent level; means not followed by any letters in common are significantly different. Each figure is the mean for two 1/20-acre plots.

Figure 2.--Pine reproduction beneath uncut strip of Virginia pine 4 years after treatment: A. Plot burned, then scarified before seedfall B. Control plot with no seedbed treatment.

sumed. In addition, much of the Virginia pine overstory was killed. This mortality was not apparent at once, but in 1 year amounted to 54 percent, and within 2 years 67 percent.

All seedbed treatments, except scarification after seedfall with no burn, eventually resulted in the establishment of significantly more pine seedlings than the controls, but the effects did not fully materialize the first year; rather, they continued to build up through the 4-year period of observation (table 1, fig. 2). At the end of the first growing season after treatment, only those plots that were both burned and scarified had significantly more seedlings than the controls. During the second growing season, pine reproduction had increased 83 percent on the burned-only plots, and 71 percent on those scarified before seedfall with no burn. These plots now had significantly more seedlings than the controls and the unburned plots scarified after seedfall. The count in 1958 (fourth year) showed essentially the same relationships, but the numbers of seedlings had increased for all treatments except the control. Even on the unburned plots scarified after seedfall, stocking now was more than twice that of the controls although this difference still fell short of statistical significance at the 5-percent level (table 1).

The treatments affected not only the number of pine seedlings but also their vigor and freedom from woody competition. The fires, by killing the ground vegetation and a large part of the overstory, freed the pine seedlings from competition and favored vigorous growth. Moreover, the burned seedbeds were relatively unfavorable for the reestablishment of many hardwood species. Therefore, in 1958 the pine seedlings on the burned plots mostly were taller than the newly invading hardwoods.

In contrast, most seedlings on the unburned plots were not freed from their competitors. Some advance hardwood reproduction survived the scarification treatments, and additional hardwoods seeded in. The side light made available when the first strips were cut was enough to stimulate growth of the relatively tolerant hardwoods without equally stimulating the pines. Consequently, on control plots and on plots that had only been scarified, the pine seedlings in 1958 generally were suppressed.

CONCLUSIONS

This study was too small to warrant definite conclusions and recommendations, but the amount of pine reproduction clearly was increased on the study plots by burning and by scarification, singly and in combination. However, since (1) fairly good stocking was obtained by burning alone, (2) the additive effect that accrued from combining scarification with burning was relatively small, (3) burning resulted in better hardwood reduction and greater vigor among pine seedlings than scarification, and (4) burning probably will be the easier treatment to apply, burning alone is suggested for further trial as a means for establishing advance pine

regeneration in the uncut strips during strip-cutting operations in Virginia pine. The suggested procedure is:

- Burn the uncut strip in the fall of a moderately good seed year after the seed have ripened but before seedfall. In Maryland, this would be during September and October (Church and Sucoff, 1960).

- Harvest the uncut strip 1 or 2 years later, preferably after August, since seed in cones on the felled trees would then be ripe.

This procedure would allow two or three seedcrops to fall on a receptive seedbed, and it would make easier logging because the underbrush would be reduced. Pines killed by the fire could be harvested with little loss provided that the purchasing mill could handle small amounts of charcoal. Further field experience will be required to determine whether results with this procedure are worth the costs and difficulties of carrying it out.

LITERATURE CITED

Bramble, William C.
1947. Effect of seedbed type and protection upon germination and early establishment of Virginia pine. Pa. State Forest School Res. Paper 9. 5 pp.

Church, Thomas W., Jr., and Sucoff, Edward I.
1960. Virginia pine seed variable two months before natural cone opening. Northeast. Forest Expt. Sta. Res. Note 102. 4 pp., illus.

Duncan, O. B.
1955. Multiple range and multiple F tests. Biometrics 11: 1-42.

Slocum, George K., and Miller, William D.
1953. Virginia pine: reproduction, growth, and management on the Hill Demonstration Forest, Durham County, North Carolina. North Carolina Agr. Expt. Sta. Tech. Bul. 100. 52 pp., illus.

Sucoff, Edward I., and Church, Thomas W., Jr.
1960. Seed production and dissemination by Virginia pine. Jour. Forestry 58: 885-888.

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